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J.G. Valan Arasu
St. Aloysius College, Jabalpur, India

A.D.N. Bajpai
Rani Durgawati University, Jabalpur, India

Shubhada Pandey
G.S. College of Commerce, Jabalpur, India

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ARTICLE

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J.G. Valan Arasu
St. Aloysius College, Jabalpur, India

A.D.N. Bajpai
Rani Durgawati University, Jabalpur, India

Shubhada Pandey
G.S. College of Commerce, Jabalpur, India

INTRODUCTION

Power is a key infrastructure, which is the backbone and prime mover of the economic development of any country because power is required for all the sectors of economy which include agriculture, industries, service, information and technology, transport and others. The term energy has been employed to designate not only chemical energy, but also kinetic energy, mechanical energy, electrical energy, radiant energy and thermal energy. These six energy sources play a vital role in the economic development of a nation, because energy facilitate to grow food; keep people alive; transport people and goods; fuel economic development and sustain the economic system.

Economic growth too is driven by energy in the form of finite resources such as coal, oil and gas or in renewable forms such as hydroelectric, wind, solar and biomass, or its converted form, electricity. Modern economists believe that an index of energy could be used as an index of capital because in "economic parlance, energy caters both to the direct consumption and the production of goods: as consumer goods, their consumption tends to vary with changes in income and consumer preferences; as an input in production, their availability and increasing quantity are a sin-qua-non of rising national income." (Ramaswamy and Chelvam – 1997)[i]

POWER AND ECONOMIC DEVELOPMENT

Energy is considered to be the prime mover of economic development and growth. A comprehensive energy regression analysis will indicate a positive relationship between aggregate economic performance and total commercial energy consumption. According to Anil Kadodkar (2004)[ii] "Energy is the engine for the growth. It multiplies human labour and increased productivity in agriculture, industry as well as services. Easy access to modern energy services holds the key to

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development." Therefore, the availability of quality power in the required quantity is one of the most important determinants in the success of the country's development. In addition providing adequate and affordable electric power is essential for economic development, human welfare and higher standard of living. India being a developing country with increasing population makes power the critical infrastructure for India.

The draft of Fifth Five-Year Plan of Government of India (1974-79)[iii] thus stated "Electricity is the most versatile form of energy and provides an infrastructure for economic development. It is a vital input for industry and agriculture, and is of particular importance to a developing rural sector, which needs more power for its agricultural operations, for its small scale and agro industries. All sectors of the economy need electricity for their common needs of water supply, transport, communication and domestic lighting. Given the large scale dependence on lift irrigation for food production, food processing and preservation industries, the increase in the power-intensive industries such as aluminum, fertilizer, petrochemicals, etc., and the increasing dependence on electric traction for transport, there is hardly any community or sector which is not affected by a power shortage today. The future development of the country, therefore, will depend upon the rate of growth of power generation capacity."

The draft of Ninth Five-Year Plan of Government of India (1997-2002)[iv] once again reinstating the need for power for the future development and growth of the country said, "Electricity is the most versatile form of energy and provides an infrastructure for economic development. It is a vital input for industry and agriculture, and is of particular importance to a developing rural sector. The future development of the country, therefore, will depend upon the rate of growth of power generation capacity." As a result, India has taken rapid strides since independence in the power sector both in terms of enhancing power generation and in making available power to widely distributed geographical boundaries. The total installed electricity generation capacity has increased from a mere 1363 MW in 1947 to about 136970 MW in 2002-03. The average growth rate over the entire period has been 8.6 percent per year (Table 2). The power transmission and distribution network has also grown substantially. However after six decades of independence a large percentage of the population in India, yet have no access to electricity and a number of villages are still out of reach of electrical power. About 70 per cent of the rural households are yet to get electric connections and power based economic activities.[v] Even per capita availability of energy is very low and India is still not in a position to overcome the power crisis. Power cuts and load shedding has become the order of the day in a number of States.

Restructuring, privatization, liberalization and globalization being the worldwide phenomenon in the power sector, the energy sector in India has witnessed rapid shift

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in financial and political ideologies. That is why even in India many began to comment that power sector reforms were an absolute necessity because "the nation should not be left behind while the rest of the world is galloping full steam ahead towards prosperity" (Phadke and Rajan -2004).[vi] Speaking on the same level a few years back when Jack Walch first came to India he said, "Infrastructure is the biggest bottleneck here… India does not have the infrastructure. The power requirement of the digital world will blow your mind…You have sent so many people back who came to set up power plants. You just do not have a chance if you do not wake up" (Trivedi - 2004).[vii]

The general driver for this transfer has been stated as 'efficiency' in resource mobilization and enhancement of supply (Venkatapathey and Priyadarshini - 2001)[viii]. The logic for this argument is that private sector involvement and competition would lead to better resource allocation and eventually improve services for end-users of electricity services. In developing countries, according to 'Washington consensus' only privatization would raise capital for power sector investments, reduce political interference, address the problems concerning non-performing public investments and public sector corruption, establish more efficient pricing and reap efficiency gains to enhance economic development.

At present in developing countries, reform efforts are focused on privatization of the publicly owned sector and establishment of an independent regulator. They also envisage market competition in the sector in the longer run. Here privatization efforts are partly justified on the basis of future potential gains from competition. India too has been influenced by the worldwide changes that are taking place in the power sector. Dr. Monmohan Singh the then Finance Minister presiding over the function at the Rajiv Gandhi Center for Contemporary Studies organized in Delhi justifying power sector reforms undertaken by the government said, "Experts found that power sector needed structural reforms, equipment change, mindset change, efficiency, cost reduction, competitiveness and quality to serve the economy needs." In response to this the reforms were conducted in technical and financial performance and capital availability. That is why the Electricity Act 2003 has been passed in the parliament.
Inspite of reforms in the power sector, from the year 1991 onwards many states have persistent power shortages. In most of the states power shortages, both in terms of peak capacity as well as electrical energy, have been common. The energy and peaking shortage at the end of the Ninth Plan are 7.5 per cent and 12.6 per cent respectively. At the end of Tenth Plan the energy and peaking shortages are 11.6 per cent and 9.5 per cent respectively (Government of India – 2002-07).[ix] As a result in many states scheduled power cuts, unscheduled outages and fluctuating voltages are common. As a result of which every consumer is forced to purchase voltage stabilizers, inverters, small diesel generator sets and burnt-out motors. Consequently all these impose large economic costs. To understand why this has been the case, it is necessary to critically examine the power sector in India.

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Till 1991 the power sector was mainly in the public sector. With a few exceptions, electricity distribution and supply, was the prerogative of state electricity boards (SEBs) of respective governments. SEBs also set up and operated generating plants. There were also central government agencies that set up and operated large generating plants that served more than one state. The Ministry of Power is responsible for making policy and planning in India's power sector The Central Electricity Authority and the new Central Electricity Regulatory Commission share regulatory responsibilities. Eleven state electricity regulatory commissions have been established and two are already fully operational. Two state-owned corporations play key roles in India's power sector: National Thermal Power Corporation, India's largest generator, and Power grid, which operate the national transmission system. State-level generation, transmission, and distribution is largely in the hands of state electricity boards, most of which are in poor physical and financial health. The power sector depends heavily on Coal India, Ltd., Indian Railways, and the Gas Authority of India, Ltd. for fuel supply.

ELECTRICITY REQUIREMENT AND AVAILABILITY

India's installed capacity for power generation has tripled over the years and now exceeds 101000 MW. However, "the total demand is expected to increase by another 3.5 times in the next two decades, even under a best-case scenario that envisions intensified efforts to modernize power plants, improve transmission and distribution efficiency and adopt more efficient generation technologies." (Gupta – 2004)[x] The soaring demand for power will necessitate a tripling of the installed generation capacity from 101000 to 292000 MW over the next two decades. **Table 1** shows how the sizable shortages of both capacity and energy have persisted from the years 1981-82 to 2000-01 even after economic liberalization. From table it is clear that in the year 2000-01 the total percentage of power shortage was only 7.2 per cent. Over the eighth five years plan the shortage of power percentage is increased to 7.8 per cent. In the year 2000-01 total power requirement was 496266 million units but the total availability of power was 457557 million units and the total shortage was 38709 million units. The power shortages reflect inadequate investment in building generating capacity and transmission network. With regard to the change in the availability of electricity in 2000-01, it was just 3.9 per cent which is much lower in comparison to the change in the availability of electricity in the year 1981-82. In the year 1981-82 the total change in the availability of power is 9.8 per cent.

From the year 1981-82 to 1990-91 the total change in the availability of electricity is 90.3 per cent, but from 1992-93 to 2000-01 the total change in the availability of electricity is just 66.8 per cent. This is much lower than what was achieved before the liberalization process. However, total energy deficit during post-liberalization period was -73.7 percent where as during pre-liberalization period energy deficit was

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-82.7 percent. This means that during post-liberalization period government has succeeded in reducing power deficit by 9 percent. After considering various reforms implemented, considered and discussed in the power sector during reforms period reduction of just 9 per cent deficit can not be considered as a considerable achievement during post-liberalization period.

Table 1

Electricity Requirement and Availability

Year	Requirement (million KwH)	Availability (million KwH)	% Change in requirements	% Change in availability	Energy Deficit
1981-82	120118	113928	7.6	9.8	-11.9
1982-83	136849	121311	5.9	6.5	-11.4
1983-84	145284	130122	6.2	7.3	-10.4
1984-85	155432	145393	7.0	11.7	-6.5
1985-86	170746	157301	9.9	8.2	-7.9
1986-87	192356	173803	12.7	10.5	-9.6
1987-88	210993	187873	9.7	8.1	-11.0
1988-89	223194	206326	5.8	9.8	-7.6
1989-90	247762	228784	11.0	10.9	-7.7
1990-91	267632	246941	8.0	7.9	-7.7
Total			**83.8**	**90.3**	**-82.7**
1991-92	288071	260136	8.0	9.0	-6.9
1992-93	305266	282384	5.6	4.9	-7.5
1993-94	323252	303681	5.9	7.5	-6.1
1994-95	352260	329255	9.0	8.4	-6.5
1995-96	389721	356441	10.6	8.3	-8.5
1996-97	413490	371395	6.1	4.2	-10.2
1997-98	436258	394989	5.5	6.4	-9.5
1998-99	446584	421488	2.4	6.7	-5.6
1999-00	480430	453205	7.6	7.5	-5.7
2000-01	507216	470777	5.6	3.9	-7.2
Total			**66.3**	**66.8**	**-73.7**

Source: Energy, Centre for Monitoring Indian Economy, Mumbai, May 2003, p. 128

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GROWTH OF INSTALLED CAPACITY

The total installed capacity grew at an average annual compound growth rate of 6.65 per cent during the last four decades. It has grown from approx. 1300 MW in 1947 to 93253 MW by the end of March 1999. Despite the significant progress in capacity addition, the demand for electricity continues to outstrip the supply with the result that energy and peak shortages continue to plague the economy. The best performance was witnessed during the Seventh Plan Period (1985-90) when 21051 MW were added as against the target of 22245 MW. However, the capacity addition during Eighth Plan was only 16423 MW against the target of 30538 MW. The share of hydel capacity in the total installed capacity is only 24 percent as compared to 46 percent at the end of 3rd Plan and that of thermal capacity went up to 76.4 per cent from 62.3 per cent. Out of the total installed plant capacity in 1997-98, 63.3 per cent was owned by the States, 30.7 percent by the Centre, and 6 per cent was in the private sector.

Table 2

Growth of Installed Generation Capacity

(Thousand MW)

Year	Hydro	Thermal	Utilities Nuclear	Total	Non-Utilities		Geothermal/Solar Wind/Biomass
1980-81	11.8	17.6	0.9	30.3	3.1	33.4	
1981-82	12.2	19.3	0.9	32.4	3.4	35.8	
1982-83	13.1	21.4	0.9	35.4	3.9	39.3	
1983-84	13.9	24.4	1.1	39.4	4.4	43.8	
1984-85	14.5	27.0	1.1	42.6	5.1	47.7	
1985-86	15.5	30.0	1.3	46.8	5.5	52.3	
1986-87	16.2	31.8	1.3	49.3	5.7	55.0	
1987-88	17.3	35.6	1.3	54.2	6.3	60.5	
1988-89	17.8	39.7	1.5	59.0	7.5	65.5	
1989-90	18.3	43.8	1.5	63.6	8.2	71.8	
1990-91	18.8	45.8	1.5	66.1	8.6	74.7	0.02

Percentage of change as on 1990-91 over 1980-81 in total installed generation capacity is 118.15 per cent

1991-92	19.2	48.1	1.8	69.1	9.3	78.4	0.03
1992-93	19.6	50.7	2.0	72.3	10.1	82.4	0.03
1993-94	20.4	54.4	2.0	76.8	10.7	87.5	0.04
1994-95	20.8	58.1	2.2	81.1	11.2	92.3	0.05
1995-96	21.0	60.1	2.2	83.3	11.8	95.1	0.12

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1996-97	21.7	61.9	2.2	85.8	12.1	97.9	0.55
1997-98	21.9	65.0	2.2	89.1	13.2	102.3	0.82
1998-99	22.4	68.7	2.2	93.3	14.1	107.4	0.93
1999-00	23.9	71.3	2.7	97.9	14.7	112.6	1.02
2000-01	25.1	73.6	2.9	101.6	15.4	117.0	1.08

Percentage of change as on 2000-01 over 1990-91 in total installed generation capacity is 52.95 per cent

2001-02	26.3	75.9	2.7	104.9	16.1	121.0	1.27
2002-03	26.8	78.4	2.7	107.9			1.51

Source: Buddhadeb Ghosh & Prabir De, India Infrastructure Database 2005, Vol. II, Bookwell New Delhi, p.1098.

The capacity addition for power generation during the Eighth Five-Year Plan period was 16742 MW, which was approximately 54.8 per cent of the planned capacity addition for the period. Of the total capacity addition, the share of hydel energy was 14.5 per cent (2428 MW) and that of thermal and nuclear energy was 85.5 per cent (14314 MW) (Banerjee).[xi] An aggregate capacity addition of 3239 MW was targeted for commissioning during the year 1997-98 against which the actual achievement was 3283 MW. Of this hydel energy accounted for 233 MW and thermal and nuclear energy 3050 MW.

The Ninth Plan programme envisaged a capacity addition of 40245 MW during the period 1997-2002, out of which 11909 MW will be in the central sector, 10784 MW in the State Sector and 17588 MW from Private Sector. As against this the actual energy generation has been 515.3 Billion Units. This is a compound annual growth rate of about 5.5 per cent during the Ninth Plan period. The capacity addition proposed in the Private Sector, if materializes fully, would be quite significant in the 9th plan compared to earlier plans. As against the average capacity addition programme of around 8000 MW per year, the capacity addition during the first two years of Ninth Plan was only 7528.3 MW. The Ninth Plan envisaged a capacity addition of 40245 MW. But the actual capacity addition was 19015 MW.

Table 2 illustrates total installed plant capacity in the form of hydro, thermal, wind and nuclear over the years. In 1980-81 total installed plant capacity in the power sector was 30.3 thousand MW and it further increased to 66.1 thousand MW in 1990-91. Percentage of change as on 1990-91over 1980-81 was 118.15 percent. Total installed capacity further increased to 101.6 thousand MW in 2000-01 and percentage of change as on 2000-01 was 52.95 percent. It means there has been shortfall in total installed plant capacity in comparison to pre-reforms period.

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Shortfall in new generation capacity addition during the Ninth Five-Year Plan is seen mostly in the private sector, because "Proposals for setting up joint-venture mega projects with American, Chinese, and Austrian power generation companies have either been taken up or are being considered. Also, there are eight fast track projects with independent producers under Government of India guarantees, already approved, although only a minor fraction of them have been taken up for actual implementation" (Banerjee 2005).[xii] The main reasons for the shortfall in capacity addition according to the Tenth Plan are: "inability to get private sector projects off the ground in the absence of adequate arrangements for ensuring payment security, delay in land acquisition and environmental clearances, unresolved issues relating to fuel linkages, contractual problems, resettlement and rehabilitation problems and law and order problems"(10th Planning Commission – 2002-07).[xiii]

GROWTH OF GROSS ENERGY GENERATION

In the early 1990s, India embarked on full-scale introduction of economic reforms thus creating way for economic growth. The GDP growth, around 4 percent in the first half of the 1990s and consecutive years the GDP stayed between 5 to 8 per cent. As a result India's primary energy consumption too expanded considerably. "BP Statistics report that India's primary energy consumption grew by 4.7 per cent year on an average from 183 MTOE in 1990, reaching 276 MTOE in 1999" (Koyama-2000).[xiv] It is right therefore to examine the growth of energy generation in India.

HYDRO POWER PLANTS

Hydroelectric power plant utilizes the potential energy of water stored in a dam built across the river. The potential energy of water is used to run water turbine to which the electric generate is coupled. The mechanical energy available at the turbine is converted into electrical energy by means of the generator. The share of hydel capacity in the total generating capacity has declined from 34 per cent at the end of the Sixth Plan to 25 per cent at the end of the Ninth Plan. The share continued to decline even during post-reforms period. Table 3 illustrates the growth of gross energy generation during pre-reforms period and post-reforms period in the energy sector. In 1980-81 the gross energy generated by hydro plants was about 56.5 billion KWH and in 1990-91 the gross energy generated by hydro plants increased to 71.7 billion KWH. Gross energy generated by hydro plants as on 1990-91 over 1980-81 was 26.90 per cent. Where as in 2000-01 the gross energy generated by hydro plants was about 74.5 billion KWH and its percentage of change as on 2000-01 over 1990-91 was 2.34 per cent. It is 24.56 per cent less than the percentage of change in terms of gross energy generated by hydro pants during 1980-81 to 1990-91.

It means that neither the public sector nor the private sector invested in hydro means of production of energy during post-reforms period. The significantly decreasing role

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of hydroelectric energy may be noted during post-reforms period. Though the raw material cost of hydroelectricity is insignificant and further is not subject to inflationary pressure, yet significant attention is not given to hydroelectric energy because too much dependence would subject energy supply to fluctuations in rainfall and vagaries of nature. It is stated that Geological uncertainty, contract management, resettlement and rehabilitation, delay in land acquisition and infrastructure development have been stated as the main reasons by the Tenth Five Year Plan for time and cost overruns in hydro projects. In order to avoid delays in project implementation and to accelerate the pace of hydro developmental projects the Tenth Five Year Plans suggests the following:

- "Bankable detailed project report based on a detailed survey should be prepared to avoid geological uncertainty.
- Contract monitoring, as distinct from project monitoring, should be emphasized.
- Land acquisition and infrastructure development should be settled and completed before the start of the project.
- Detailed ranking study and preparation of detailed feasibility report based on economic viability needs to be done.
- Adopt a national rehabilitation policy and implement the policy uniformly.
- Streamline clearances for pursuing priority projects.
- Simplify approval procedures.
- Facilitate the early financial closure of projects through a concerted approach towards multilateral agencies and other international funding sources" (Planning Commission -2002-07).[xv]

THERMAL POWER PLANTS

Thermal power generated by coal and oil has been the major source of electric power in India. Mostly thermal power is derived from coal and only a small fraction comes from oil. The performance of the thermal power plants registered an overall improvement during the Ninth Five Year Plan. The all India average Plant Load Factor (PLF) of the thermal power plants was 64.4 per cent at the beginning of the Ninth Plan and had increased to 69.9 per cent by the end of the Plan period. However the comparative analysis of post-reforms and pre-reforms period reveals a different picture all together.

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Table 3

Growth of Gross Energy Generation

					Billion KWH	
Year	Hydro	Utilities Thermal@	Nuclear	Total	Non Utilities	Total
1980-81	56.5	61.3	3.0	120.8	8.4	129.2
1981-82	49.6	69.5	3.0	122.1	9.0	131.1
1982-83	48.4	79.9	2.0	130.3	10.0	140.3
1983-84	50.0	86.7	3.5	140.2	10.8	151.0
1984-85	53.9	98.8	4.1	156.8	12.3	169.1
1985-86	51.0	114.4	5.0	170.4	13.0	183.4
1986-87	53.8	128.9	5.0	187.7	13.6	201.3
1987-88	47.5	149.6	5.0	202.1	16.9	219.0
1988-89	57.9	157.7	5.8	221.4	19.9	241.3
1989-90	62.1	178.7	4.6	245.4	23.0	268.4
1990-91	71.7	186.5	6.1	264.3	25.1	289.4
% of Change Over						
1980-81	**26.90**	**204.24**	**103.33**	**103.15**		
1991-92	72.8	208.7	5.5	287.0	28.6	315.6
1992-93	69.9	224.8	6.7	301.4	31.3	332.7
1993-94	70.4	248.2	5.4	324.0	32.3	356.3
1994-95	82.7	262.1	5.6	350.4	35.1	385.5
1995-96	72.6	299.3	8.0	379.9	38.2	418.1
1996-97	68.9	317.9	9.1	395.9	40.8	436.7
1997-98	74.6	337.0	10.1	421.7	44.1	465.8
1998-99	82.9	353.7	11.9	448.5	48.4	496.9
1999-00	80.6	386.8	13.3	480.7	51.5	532.2
2000-01	74.5	408.1	16.9	499.5	55.0	554.5
% of Change Over						
1991-92	**2.34**	**95.54**	**152.23**	**88.99**		
2001-02*	73.9	422.0	19.3	515.2	58.0	573.2
2002-03	64.0	449.3	19.4	532.7		

* Provisional @ Includes Wind

Note: Figures may not add up to the total owing to rounding off.

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Source: Buddhadeb Ghosh & Prabir De, India Infrastructure Database 2005, Vol. II, Bookwell New Delhi, p.1099.

The energy generated though thermal plants in 1980-81 was about 61.3 billion KWH and in 1990-91 gross energy generated through thermal plants increased to 186.5 billion KWH. Gross energy generated through thermal plants as on 1990-91 over 1980-81 was 204.24 per cent. Where as in 2000-01 the gross energy generated by thermal plants was about 408.1 billion KWH and its percentage of change as on 2000-01 over 1990-91 was 95.54 per cent. It is 108.7 per cent less than the percentage of change in terms of gross energy produced by thermal pants during 1980-81 to 1990-91. It means that neither the public sector nor the private sector invested much in thermal means of energy production during post-reforms period. However a thermal power station is liable to cause environmental pollution and air pollution. The major areas of concern are surface and groundwater pollution, noise pollution, change of land-use pattern, impact on green cover and on flora and fauna etc.

NUCLEAR POWER PLANTS

Nuclear energy is considered to an important source of electric power. It is considered that it has environmental advantages and is also likely to be economical in the longer run. As a result comparative study between post-reforms and pre-reforms period on nuclear method of energy generation shows quite different picture all together in comparison to thermal and hydro method of power generation. Nuclear plants were preferred over other means of energy production during post-reforms period because an expanded programme of energy generation through nuclear method would make it possible to reduce the costs of construction and power generation. Tenth Five Year Plan therefore states that "aggressive nuclear power development is essential in the context of energy security, environmental advantages and changing perceptions about nuclear power in developed countries…Improvements in nuclear technology are likely to make nuclear power more economical and total life cycle costs more competitive in comparison to other fuels."(Planning Commission 2002-07)[xvi]

Energy generated though nuclear plants in 1980-81 was about 3 billion KWH and in 1990-91 it increased to 6.1 billion KWH. Gross energy generated through nuclear plants as on 1990-91 over 1980-81 was 103.33 per cent. In 2000-01 gross energy generated by nuclear plants was about 16.9 billion KWH and its percentage of change as on 2000-01 over 1990-91 was 152.23 per cent. It is 48.9 per cent higher than the percentage of change in terms of gross energy produced by nuclear pants during 1980-81 to 1990-91.

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GROSS POWER GENERATION BY ALL PLANTS

In 1980-81 the gross energy generated was about 120.8 billion KWH and in 1990-91 the gross energy generated increased to 264.3 billion KWH. The growth of gross energy generated as on 1990-91 over 1980-81 was 103.15 per cent. Where as in 2000-01 the gross energy generated was about 499.5 billion KWH and its percentage of change as on 2000-01 over 1990-91 was 88.99 per cent. It is just 14.16 per cent less than the percentage of change in terms of gross energy generated during 1980-81 to 1990-91. It means that the open invitation rendered to private sector participation in the energy sector did not lead to increase in gross energy generated in the country. The policy of inducting private investment into the power sector was expected to result in the addition of 17588 MW of power capacity during the Ninth Plan. But the actual addition was 5061 MW, which is a mere 29 per cent of the target. The main impediments in private sector investment in power sector according to the Tenth Five Year Plan have been:

- "The chronic financial weakness of SEBs.
- Unviable tariffs to IPPs, due to factors such as high cost of liquid fuels, risk factors and slow growth in demand …
- The absence of an enabling regulatory, legislative and market environment.
- The slow pace of reform in the power sector and related sectors such as coal, transport.
- The inability to deliver bankable contractual frameworks.
- The lack of recognition of the fact that the distribution segment would need to be made efficient and bankable before private investment and competition emerges in generation" (Planning Commission – 2002-07).[xvii]

According to energylineindia.com the country's total generation capacity stood at 124172 MW as on March 17, 2006. Of this, the thermal and hydro segments accounted for 82369 MW and 32335 MW capacities respectively. The renewable energy source-based generation capacity was pegged at 6,158 MW while the rest was nuclear generation capacity. In the thermal segment, coal-fired capacity was put at 68433 MW.[xviii] Gas-based capacity accounted for 12,734 MW while the rest was based on costly liquid fuels.

RURAL ELECTRIFICATION

Rural electrification is an important component in rural development, because the availability of power in rural areas will lead to economic development. As a result Indian Government has been making plans and allocating finance for village electrification since beginning of the planning process. Around 86 per cent of the villages have been electrified up the year 2005. However **table 4** below reveals that there has been a deceleration in the rural electrification programme during the Eighth Five Year Plan and the Ninth Five Year Plan compared to the Sixth Five Year Plan

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and Seventh Five Year Plans. As a result about 70 per cent of the rural households are yet to get electric connections.

Table: 4

Progress in Rural Electrification

Year	Villages Electrified in 2000s	Villages Electrified as % of total villages	Pump sets energized 2000s
1980-81	272.4	47.3	4330.5
1985-86	390.3	67.7	6152.0
1990-91	481.1	83.1	8909.1
1991-92	487.2	84.1	9391.1
1992-93	490.8	84.8	9851.2
1993-94	494.2	85.3	10276.6
1994-95	497.7	86.3	10619.5
1995-96	501.8	86.7	11104.1
1996-97	498.8	84.9	11565.3
1997-98	502.0		11849.4
1998-99	504.7		12215.1
1999-00	506.9		12514.2*
2000-01	508.1		
2001-02	512.2@		
2002-03	492.3@		
1-1-2005	497.1	84.7	14290.6

Note:* Also comprises the latest data as per the Tenth Plan Document
@ Also comprises the data given in India Infrastructure Database 2005, Vol. II, p.1069.

Source: Bani P. Banerjee, Handbook of Energy and the Environment in India, Oxford University Press, 2005, p.181.

About 80000 villages remain to be electrified, of these, 18000 villages are in remote and difficult areas where grid supply may not be feasible. Non-conventional energy sources have to play a critical role in electrifying these villages and meeting their energy needs. The Tenth Five Year Plan therefore rightly holds that "the actual benefits of the investments made in the rural electrification programme can only be realized if the people are in a position to use electricity for their day-to-day activities as well as for industrial and commercial activity. Therefore … rural electrification programme … must also ensure more widespread use of electricity by the rural

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people in a time-bound manner" (Planning Commission – 2002-07).[xix] For this involvement of the community NGOs and Panchayati Raj Institutions has been envisaged and Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY) programme has been incited to achieve this objective. At present, only 44 per cent of the rural households have access to electricity. The services of Central Public Sector Undertakings (CPSUs) have been offered to the States for assisting them in the execution of rural electrification projects as per their willingness and requirement.

PROGRESS OF IMPLEMENTATION OF RGGVY

As per Economic Survey 2005-2006 the following programmes have been undertaken and implemented under Rajiv Gandhi Grameen Vidyutikaran Yojna:

- "So far 187 projects for 191 districts have been sanctioned covering 22 States at the cost of Rs.6,241.86 crore covering 51,284 un-electrified villages and 69.29 lakh rural households, of which 45.15 lakh are BPL households.
- Notice Inviting Tenders (NITs) have been issued for projects covering 163 districts.
- Contracts have been placed for projects covering 95 districts covering 41,461 un-electrified villages and 9,379 electrified villages.
- CPSUs are working in 131 districts.
- 1,941 villages have been electrified till December, 2005"[xx]

Since around 18000 villages are located in remote and difficult areas the Tenth Plan has proposed to electrify 5000 villages through decentralized energy sources (Planning Commission).[xxi]

CONCLUSION

In India we are at the crossroad of development of the power sector. Since independence tremendous strides have been made in this sector. Despite this much more remains to be done. Power has been one of the main drivers of the growth of our economy. It is essential to ensure that lack of power does not become a drag on the accelerated growth which we are aiming at. The estimated capacity addition of 1 lac MW during the 10^{th} and 11^{th} plan will need periodic review so that it is in line with the projected GDP growth rate at 9 percent per annum during the 10^{th} Plan and explosion of growth in the IT sector. Supply and demand gap is likely to widen, unless capacity addition is more than doubled in each of the next two Five Year Plan periods compared to the 8^{th} and 9^{th} Plans.

The power sector in India therefore needs the concept of an integrated energy strategy. It means a system and process of coordinated decision-making and actions that bring various energy activities and decisions into a common framework. The institutional structure that allows integration of energy decision-making would rest

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on a system of integrated analysis, monitoring and coordinated decision-making that becomes a regular part of policy formulation and implementation.

For example T & D losses comprise both the technical and commercial losses. T & D losses appear significantly in Low-Tension system and High-Tension sectors. Prayas, an NGO, brought this in its study by stating that "the starting point in the battle against excessive T and D losses should be to institute an effective energy audit at the HT level. Such an approach is desirable for many reasons, which include relatively small requirements of investment and managerial efforts, high cost-benefit ratio, higher tariff and small number of consumers" (Godbole – 2002).[xxii]

The second-generation reforms should focus on open access to transmission and distribution system. CERC has already notified grid code for the control and dispatch of power from one system to other system and asked suggestions from those involved in the sector. Open access to the transmission and distribution facilities by various utilities will enable wheeling of power from one region to other region at the lowest cost to the consumers and would further encourage investments in transmission network and generating capacities. This will introduce competition not only among various generating companies but also at the distribution level and will enable improvements in revenue collection and in which the voltage and frequency will be maintained at nominal levels. Only then India will be able to reap the fullest benefits of Power Pooling.

Reforms should aim at allowing freedom to the consumers to get power from any distributor/generating company of his choice and also introduction of differential pricing of power according to the time of the day giving incentives to users to shift their demand to the off peak period. There should be a mandatory provision to encourage use of solar energy for heating, say water heating, in certain categories of buildings.

The power sector today is in need of a holistic approach to reap the potential benefit which various reforms could render. Thus there is a "need for a coordinated movement across all sectors linked to the provision of energy services" (TERI – 2002).[xxiii] The success of reforms in India "will depend upon the existence of some sort of restraining or disciplining mechanism in the sector. In the absence of which, efforts made will likely result in a transition from inefficient public ownership to profit-gouging monopolies or oligarchies" (Phadke and Rajan - 2003).[xxiv] Thus to enable competition, acceleration of economic growth and to raise the comfort level of the common man, the major challenge of the power sector is to continue with the reforms, improve the financial health of the utilities, so that power could be made available at quality and affordable price.

FOOT NOTES

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A teleological explanation is thus one which explains parts in terms of the whole, details in terms of the structure to which they belong, structure in terms of its organizing principle, and process in terms of the pattern which it brings into being. In such process the determining factor – the teleological principle – is the implicit (or immanent) influence of the organizing principle in every phase. So it is the architect's blueprint that determines the process of building the house, the general's plan that determines the course of the battle.

Errol E. Harris, *Mechanism and Teleology in Contemporary Thought*
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